

TOSHIBA

STORAGE DEVICE DIVISION

SD-R5112 DVD-R/-RW DRIVE PRODUCT SPECIFICATION

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Specifications are subject to change without notice

**DOCUMENT NUMBER
16004**

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1. This equipment does not involve any over-current protection circuit. Use an appropriate over-current protection in the computer system which this equipment would be connected. Toshiba shall not be liable for any damages to the system which does not have any over-current protection.
2. **DO NOT** disassemble or modify this equipment. Toshiba shall not make any guarantee to the reliability, safety and performance of this equipment expressly provided in the specification and nor be liable for any damages resulting from such unauthorized disassembly or modification.
3. Read carefully and comply with this Product Specification in order to avoid the risk of data error in writing operation. Such possible data error would be made by any factors other than this equipment (i.e., poor storage media, misuse of this equipment, malfunction in a computer system connecting this equipment, etc.). Toshiba shall not be liable for any damages resulting from such data loss. Check whether the original data is correctly copied or stored upon completion of writing operation.
Take any necessary measures to protect your data such as system backup and/or mirroring disk subsystems in order to avoid the risk of unexpected data loss or data corruption resulting from failure in this equipment for some reasons.

Manufacturers and resellers of the computer system using this equipment shall be required to consider the safety of such computer system and data integrity in order to avoid the risk of any consequential damages caused by data loss or data corruption and any problems or accident caused by malfunction of the computer system.

DO NOT use this equipment in the system such as medical equipment which may cause personal injury or property damages resulting from malfunction of this equipment and unexpected data corruption or data error in reading operation.

4. Turn off the power for this equipment and wait more than one (1) minute before you eject the disc using the emergency eject mechanism when a disc cannot be ejected for some reasons in order to avoid the risk of damages to the disc.

Notice

1. Turn off the system power before mounting/removing this equipment in order to avoid the risk of damages to this equipment.
2. Insert the DC power plug in correct direction in order to avoid the risk of damages to this equipment.
3. Handle this equipment only in electrostatically safe environment and **do not** touch connecting terminals with empty hands when you build in or pull out this equipment from other product in order to avoid the risk of malfunction of this equipment.
4. **DO NOT** do any of the following:
 - 4.1. **DO NOT** use storage media (CD's / DVD's) that are not the correct size or shape, or do not meet the minimum formatting requirements set forth in section 3.1.(1) of this Product Specification.
 - 4.2. **DO NOT** insert more than one (1) CD or DVD disc into the drive at any time. Doing so will damage or destroy this equipment and could damage or destroy the disc or cause data loss or corruption.
 - 4.3. **DO NOT** load or eject any CD or DVD disc with force. Doing so will damage or destroy this equipment and could damage or destroy the disc or cause data loss or destruction.
 - 4.4. **DO NOT** eject a CD or DVD disc while the drive is in operation. Doing so will damage or destroy this equipment and could damage or destroy the disc or cause data loss or corruption.
 - 4.5. **DO NOT** insert anything else into the drive other than a CD or DVD disc. Doing so will damage or destroy this equipment.
5. When you close the tray, power must not be turned off. If the tray is pushed in with the hand during power off, a breakdown may occur because the mechanism in the product is not in the transit state during power off.

6. As for mounting bracket to incorporate this product into an equipment,

- (1) When this product is incorporated into an equipment by using the mounting screw holes in the right and left side planes, the clearance between this product and the mounting bracket is too wide;
- (2) When this product is incorporated into an equipment by using the mounting screw hole in the bottom, the surface of the mounting bracket is contorted.

If you use such mounting bracket as the above, this product will become deformed, which may cause operation failure. Therefore, it is necessary to take account of the mounting bracket which has the tolerances shown in Fig.1 or whose structure cannot cause this product to deform, as shown in Fig.2

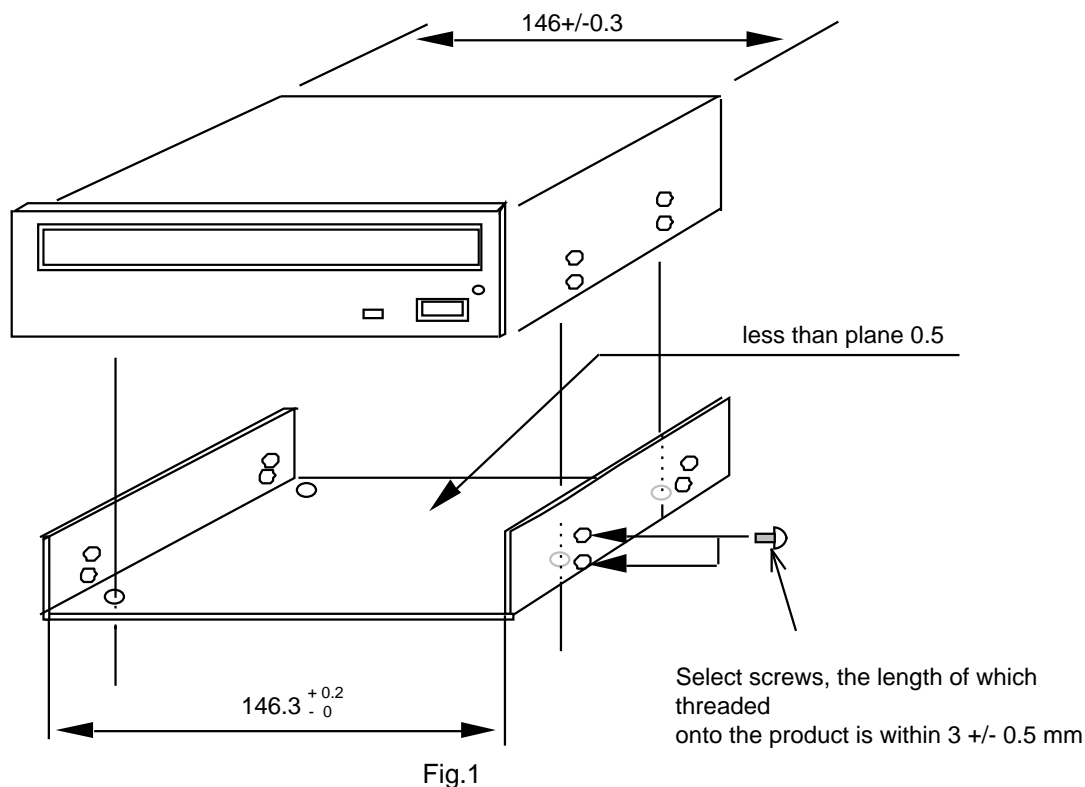


Fig.1

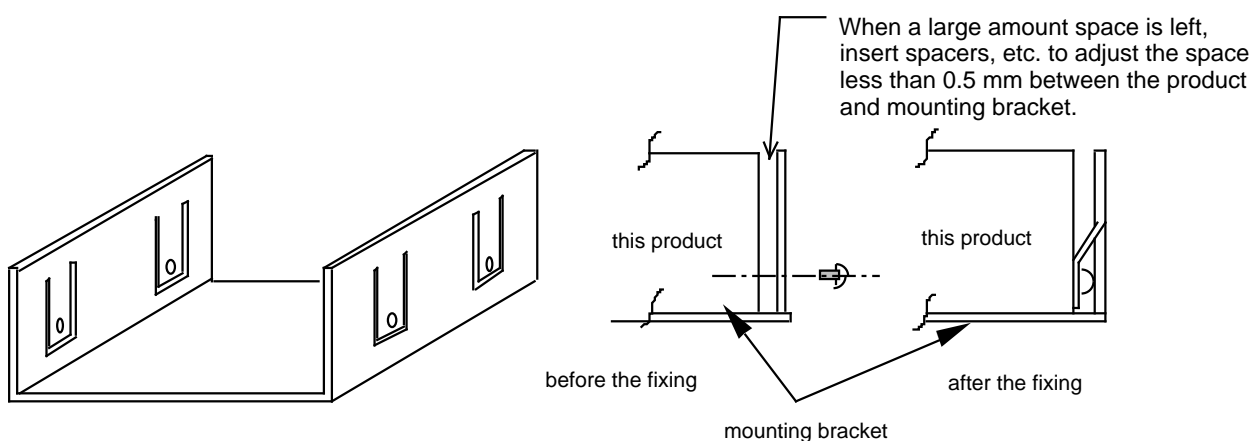


Fig.2

7. In the market, there are some drives or players that maintain to read CD or DVD disc, though, they may not designed to read CD-RW or DVD-RW disc.

When you try to read the CD-RW or DVD-RW disc written by this product using other drives or players, please make sure that the equipment is applicable to CD-RW or DVD-RW disc.

8. In the instruction manual of your product, statement described in "Safety Instruction Manual "attached to this product, the statement described in " Cautions " above, the statement of item 4 and 5 above, and other required statements should be mentioned for thorough understanding by the users.

----- Notes about Copyright: -----

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Notice

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1. Introduction

This document describes TOSHIBA's SD-R5112 DVD-R/-RW Drive.

2. Features

This drive reads DVD CSS (Contents Scramble Systems) Disc.

This drive reads digital data stored on CD-ROM, DVD-ROM and CD audio discs.

This drive read and records the digital data on DVD-R/-RW and CD-R/RW discs.

This drive reads digital stored on DVD-ROM discs at maximum 12 times faster rotational speed.

This drive reads digital stored on CD-ROM discs at maximum 40 times faster rotational speed.

This drive records (write once) digital data on DVD-R disc at 1, 2, 4 times faster rotational speed.

This drive writes / rewrites digital data on DVD-RW disc at 1, 2 time rotational speed.

This drive corresponds to 4.3GB disc (single side) / 9.4 GB disc (double side) at time of reading DVD-RAM disc and digital stored on DVD-RAM disc at standard rotational speed.

This drive records (write once) digital data on CD-R disc at 4 to 16 times faster rotational speed.

This drive writes / rewrites digital data on CD-RW disc at 4 times faster rotational speed.

This drive writes / rewrites digital data on Hight-Speed CD-RW disc at 4,10 times faster rotational speed.

This drive offers long life and durability because the disc is written / read by a LASER, thereby eliminating physical contact with the disc.

This drive supports SFF-8020i of ATAPI (ATA Packet Interface) spec. ,SFF-8090 Ver.5 (Mt.Fuji5) of DVD Commands.

This drive shows a highest performance such as 100,000 hour MTBF.

This drive adopts RPC-II for its "Standard Specification Model".

This drive support "Buffer underrun prevention" function.

Note:

DVD-ROM disc spec (DVD-ROM Book) defines 120 mm and 80 mm in diameter, single and dual layers as recording layer structure and single and double sides as recording side.

Maximum storage capacities are 4.38 GBytes and 15.9 GBytes for single layer/single side and dual layer/double side respectively. (1 GByte=2³⁰ Bytes)

3. Specifications

3.1. Performance

(1) Applicable Write Format

DVD-R	: Disc at once, Incremental write
DVD-RW	: Disc at once, Incremental write, Restricted overwrite
CD-R/RW	: Disc at once, Track at once, Session at once, Packet write

(2) Applicable Write Disc *1

DVD-R	: DVD-R for General (Ver.2.01) Optional Spec. Rev.1.0
DVD-RW	: DVD-RW (Ver1.1) Optional Spec. Rev.1.0
CD-R/RW	: CD-DA, CD+(E)G, CD-MIDI, CD-ROM, CD-ROM XA, MIXED MODE CD, CD-I, CD-I Bridge (Photo-CD, Video-CD) Multisession CD (Photo-CD, CD-EXTRA, Portfolio)

(3) Applicable Read Disc *1

DVD	: DVD-ROM (DVD-5, DVD-9, DVD-10, DVD-18), DVD-R for General (Ver.2.01) DVD-RW (Ver.1.1) DVD-RAM (Read Ver. 2.1)
CD	: CD-DA, CD+(E)G, CD-MIDI, CD-TEXT, CD-ROM, CD-ROM XA, CD-I, CD-I Bridge (Photo-CD, Video-CD) Multisession CD (Photo-CD, CD-EXTRA, CD-R, CD-RW, Portfolio), CD-R, CD-RW

(4) Data Capacity (1 GB=2³⁰ Byte, 1 MB=2²⁰ Byte, 1 KB=2¹⁰ Byte)

User Data/Block

DVD-ROM	: 2,048 Byte/Block
DVD-RAM	: 2,048 Byte/Block
CD-ROM	: 2,048 Byte/Block (Mode 1) 2,336 Byte/Block (Mode 2)

Data Capacity/Disc

DVD-5	: 4.377 GB (4.700 Billion Byte)
DVD-9	: 7.959 GB (8.545 Billion Byte)
DVD-10	: 8.754 GB (9.400 Billion Byte)
DVD-18	: 15.917 GB (17.091 Billion Byte)
DVD-R Ver.1.0	: 3.679 GB (3.950 Billion Byte)
DVD-R Ver.2.0	: 4.377 GB (4.700 Billion Byte)
DVD-RW Ver.1.1	: 4.377 GB (4.700 Billion Byte)
DVD-RAM Ver.2.1	: 4.377 GB (4.700 Billion Byte)
CD (Mode-1)	: 656.5 MB (688.4 Million Byte)
CD (Mode-2)	: 748.8 MB (785.2 Million Byte)

(5) Rotational Speed

DVD (Single)	: Approx. 7,580 rpm (5.0-12X CAV)
DVD (Dual)	: Approx. 5,053 rpm (3.3-8X CAV)
DVD-R Ver.1.0	: Approx. 3,200 rpm (2-4.8X CAV)
DVD-R Ver.2.0	: Approx. 2,780 rpm (2-4.8X CAV)
DVD-RW Ver.1.1	: Approx. 2,780 rpm (2-4.8X CAV)
DVD-Video (CSS-Disc)	: Approx. 2,780 rpm (2-4.8X CAV)
DVD-R Ver.2.0 (Write)	: Approx. 550-1,390 rpm (1X CLV)
	: Approx. 1,100-2,780 rpm (2X CLV)
	: Approx. 2,200-5,560 rpm (4X CLV)
DVD-RW Ver.1.1 (Write)	: Approx. 550-1,390 rpm (1X CLV)
	: Approx. 1,100-2,780 rpm (2X CLV)
DVD-RAM Ver.2.1	: Approx. 1,380-3,300 rpm (1X ZCLV)
CD-ROM, CD-R	: Approx. 8,561 rpm (17.2-40X CAV)
CD-RW	: Approx. 4,281 rpm (8.6-20X CAV)
CD-DA Transfar	: Approx. 3,200 rpm (12.7-16X CAV)
CD-DA, Video-CD	: Approx. 1,200-2,000 rpm (4-6X PCAV)
CD-R (Write)	: Approx. 3,400-5,940 rpm (12,16X ZCLV)
	: Approx. 2,550-5,940 rpm (12X CLV)
	: Approx. 1,700-3,960 rpm (8X CLV)
	: Approx. 850-1,980 rpm (4X CLV)
Hight speed CD-RW (Write)	: Approx. 2,125-4,950 rpm (10X CLV)
	: Approx. 850-1,980 rpm (4X CLV)
CD-RW (Write)	: Approx. 850-1,980 rpm (4X CLV)

(6) Transfer Rate (1 KByte=2¹⁰ Byte=1,024 Bytes, 1 Mbyte=2²⁰ Byte=1,048,576 Bytes)

Sustained Block Transfer Rate

DVD (Single)	: CAV 3,341-8,100 Block/s
DVD (Dual)	: CAV 2,216-5,400 Block/s
DVD-VIDEO (CSS Disc)	: CAV 1,352-3,268 Block/s
DVD-R, DVD-RW	: CAV 1,352-3,268 Block/s
DVD-RAM	: ZCLV 1,352 Block/s
CD	: CAV 1,290-3,000 Block/s
	: PCAV 300-450 Block/s
CD-RW	: CAV 645-1,500 Block/s
	: PCAV 300-450 Block/s

Sustained Data Transfer Rate

DVD (Single)	: CAV 6,682-16,200 KByte/s
DVD (Dual)	: CAV 4,432-10,800 KByte/s
DVD-VIDEO (CSS Disc)	: CAV 2,704-6,536 KByte/s
DVD-R, DVD-RW	: CAV 2,704-6,536 KByte/s
DCD-RAM	: ZCLV 2,704 KByte/s
CD	: Mode-1 CAV 2,588-6,000 KByte/s
	PCAV 600-900 KByte/s
	: Mode-2 CAV 2,950-6,843 KByte/s
	PCAV 684-1,026 KByte/s
CD-RW	: Mode-1 CAV 1,294-3,000 KByte/s
	PCAV 600-900 KByte/s
	: Mode-2 CAV 1,475-3,422 KByte/s
	PCAV 684-1,026 KByte/s

Burst DataTransfer Rate

16.7 MByte/s (PIO Mode 4)
 16.7 MByte/s (Multiple word DMA transfer mode-2)
 33.3 MByte/s (Ultra DMA mode-2)

(7) Access Time

Average Random Access Time	DVD*2	: 130 ms Typ
	CD*3	: 110 ms Typ
	DVD-RAM*4	: 200 ms Typ

Average Random Seek Time	DVD*5	: 120 ms Typ
	CD*6	: 105 ms Typ
	DVD-RAM*7	: 160 ms Typ

Average Full Stroke Access Time	DVD*8	: 210 ms Typ
	CD*9	: 180 ms Typ
	DVD-RAM*10	: 400 ms Typ

(8) Spin up Time (Focus Search Time and Disc Motor Start up Time)

DVD	: 2.0 s Typ
DVD-RAM	: 2.0 s Typ
CD	: 2.0 s Typ

(9) Data Buffer Capacity

2,048 KByte

- *1: All disc written in CD or DVD formats, except CD-DA (audio), require additional specific application software and/or hardware. This drive referred in the specification is capable of reading these data formats. However, in order to run applications that use these formats you must first have the required software and/or hardware.
- *2: Measured by performing multiple accesses which means reads of data blocks over whole area of the media from 0 (h) Frame to 1E7725(h) (4.089 Billion Byte:87 % of total area) Frame more than 3000 times. Includes positioning, setting, latency time and ECC implementation time (if required).
- *3: Measured by performing multiple accesses which means reads of data blocks over whole area of the media from 00 min 02 sec 00 Frame to 60 min 01 sec 74 Frame (552.96 Million Byte:87 % of total area at linear velocity of 1.3 m/s) more than 3000 times. Includes positioning, setting, latency time and ECC implementation time (if required).
- *4: Measured by performing multiple accesses which means reads of data blocks over whole area of the media from 0 (h) Frame to 1E7725(h) (DVD-RAM Ver.2.1 Disc) Frame more than 3000 times. Includes positioning, setting, latency time and ECC implementation time (if required).
- *5: Measured by performing multiple seek which means seeks of data block over whole area of the media from 0(h) Frame to 1E7725(h) Frame more than 3000 times.
Includes positioning, setting time which is same definition as HDD.
- *6: Measured by performing multiple seek which means seeks of data block over whole area of the media from 00 min 02 sec 00 Frame to 60 min 01 sec 74 Frame more than 3000 times. Includes positioning, setting time which is same definition as HDD.
- *7: Measured by performing multiple seek which means seeks of data block over whole area of the media from 0(h) Frame to 1E7725(h) (DVD-RAM Ver2.1 Disc) block more than 3000 times. Includes positioning, setting time which is same definition as HDD.
- *8: Measured by performing maximum accesses which means reads of each data block of 0 (h) Frame and 1E7725(h) Frame alternately more than 100 times.
Includes positioning, setting, latency time and ECC implementation time (if required)
- *9: Measured by performing maximum accesses which means reads of each data block of 00 min 02 sec 00 Frame and 60 min 01 sec 74 Frame alternately more than 100 times.
Includes positioning, setting, latency time and ECC implementation time (if required)
- *10: Measured by performing maximum accesses which means reads of each data block of 0(h) block to 1E7725(h) (DVD-RAM Ver.2.1 Disc) block alternately more than 100 times. Includes positioning, setting, latency time and ECC implementation time (if required)

(9) Load/Eject	(a) Electrical Load/Eject (Eject Button) (b) Load/Eject by ATAPI command (c) Emergency Eject
(10) Air Flow	Not Required
(11) Acoustic Noise	40 dB (IEC 179 A weighted at 1 m)
(12) Power Supply	+5 V , +12 V (details in Section 7)

3.2. Environmental Conditions

This drive should be used under the conditions listed below.

3.2.1. Temperature and Humidity

(1) Operating Temperature	5 °C to 50 °C ^{*1}
(2) Storage Temperature	-10 °C to 60 °C
(3) Shipping Temperature	-40 °C to 65 °C ^{*2}
(4) Operating Temperature Gradient	11 °C/hour (max)
(5) Storage Temperature Gradient	20 °C/hour (max)
(6) Shipping Temperature Gradient	20 °C/hour (max) ^{*2}
(7) Operating Humidity	8 % to 80 % (Wet bulb Maximum Temperature 27 °C)
(8) Storage Humidity	5 % to 95 % (Wet bulb Maximum Temperature 40 °C)
(9) Shipping Humidity	5 % to 95 % ^{*2} (Wet bulb Maximum Temperature 40 °C)
(10) Condensation	In all the above conditions there must be no condensation

^{*1}: Excluding medium.

^{*2}: Packed in Toshiba original shipping package.

3.2.2.Dust and Dirt unspecified

3.2.3.Vibration

- (1) Operating (1 Oct/min) ----- no hard error -----
 5 to 500 Hz 2.45 m/s² [0.25 G] (0-p)
 (excluding resonance point)
- (2) Operating (Write) (1 Oct/min) ----- no hard error -----
 5 to 500 Hz 2.45 m/s² [0.25 G] (0-p)
 (excluding resonance point)
- (3) Non-operating (1 Oct/min) ----- no damage -----
 5 to 10 Hz 5 mm (p-p)
 10 to 500 Hz 9.8 m/s² [1 G] (0-p)
- (4) Shipping (Packaged) (1 Oct/min) ----- no damage -----
 10 to 25 Hz 9.8 m/s² [1G] (0-p) X Y Z/30 min each

3.2.4.Atmospheric Pressure and Altitude

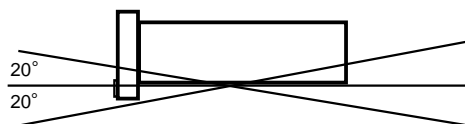
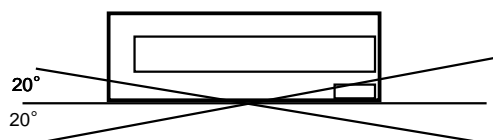
- (1) Operating 0 to 3,000 m
- (2) Shipping 0 to 12,000 m

3.2.5.Shock

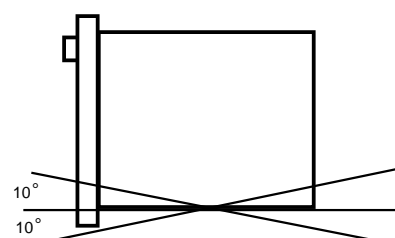
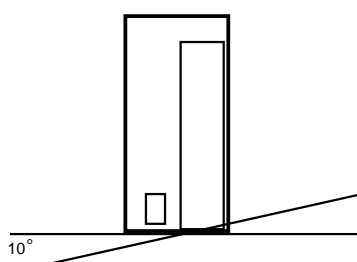
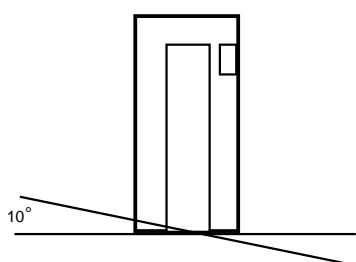
- (1) Operating (Read) ----- no retry -----
 14.7 m/s² [1.5 G] (Horizontal)
 7.8 m/s² [0.8 G] (Vertical)
 (Half sine wave 11 ms/10 s interval)
- no data loss -----
 98 m/s² [10 G]
 (Half sine wave 11 ms/10 s interval)
- (2) Operating (Write) ----- no error -----
 14.7 m/s² [1.5 G] (Horizontal)
 7.8 m/s² [0.8 G] (Vertical)
 (Half sine wave 11 ms/10 s interval)
- (3) Non-operating (with no Disc mounted) ----- no damage -----
 490 m/s² [50 G] (Half sine wave 11 ms)
- (4) Drop (Packaged) ----- no damage -----
 (a) Bulk package (10 pcs.) 0.6 m drop once for each 6-surfaces, 1-edge and 1-corner
 (b) Bulk Package (15 pcs.) 1 drop at 0.4 m (Bottom side only)

3.3. Installation Conditions

Mount the drive within 20° of the horizontal positions and
within 10° of the vertical positions



a) Horizontal position



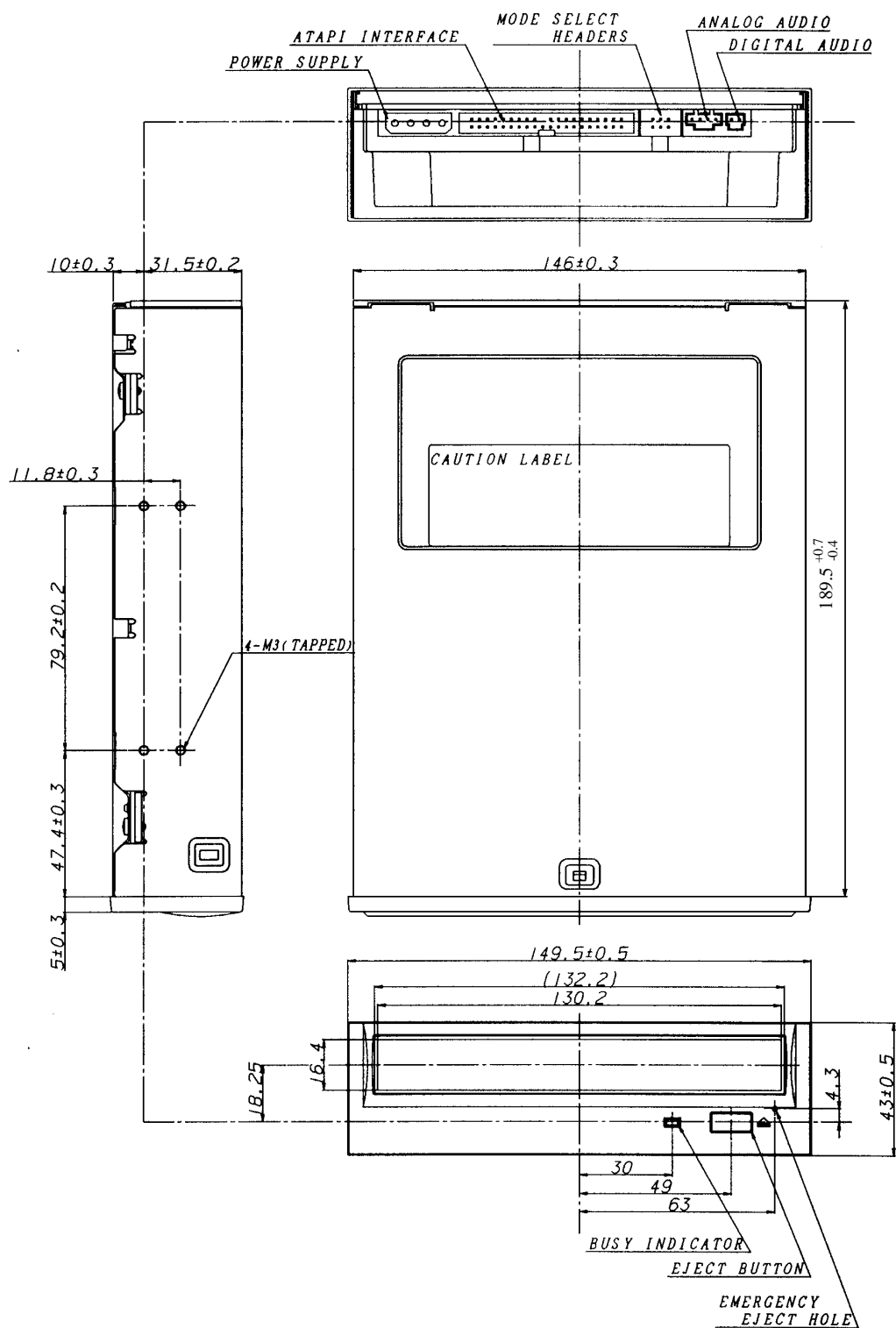
b) Vertical position

Figure 1 Installation position

3.4. Dimension and Mass ----- See Figure 2 for details -----

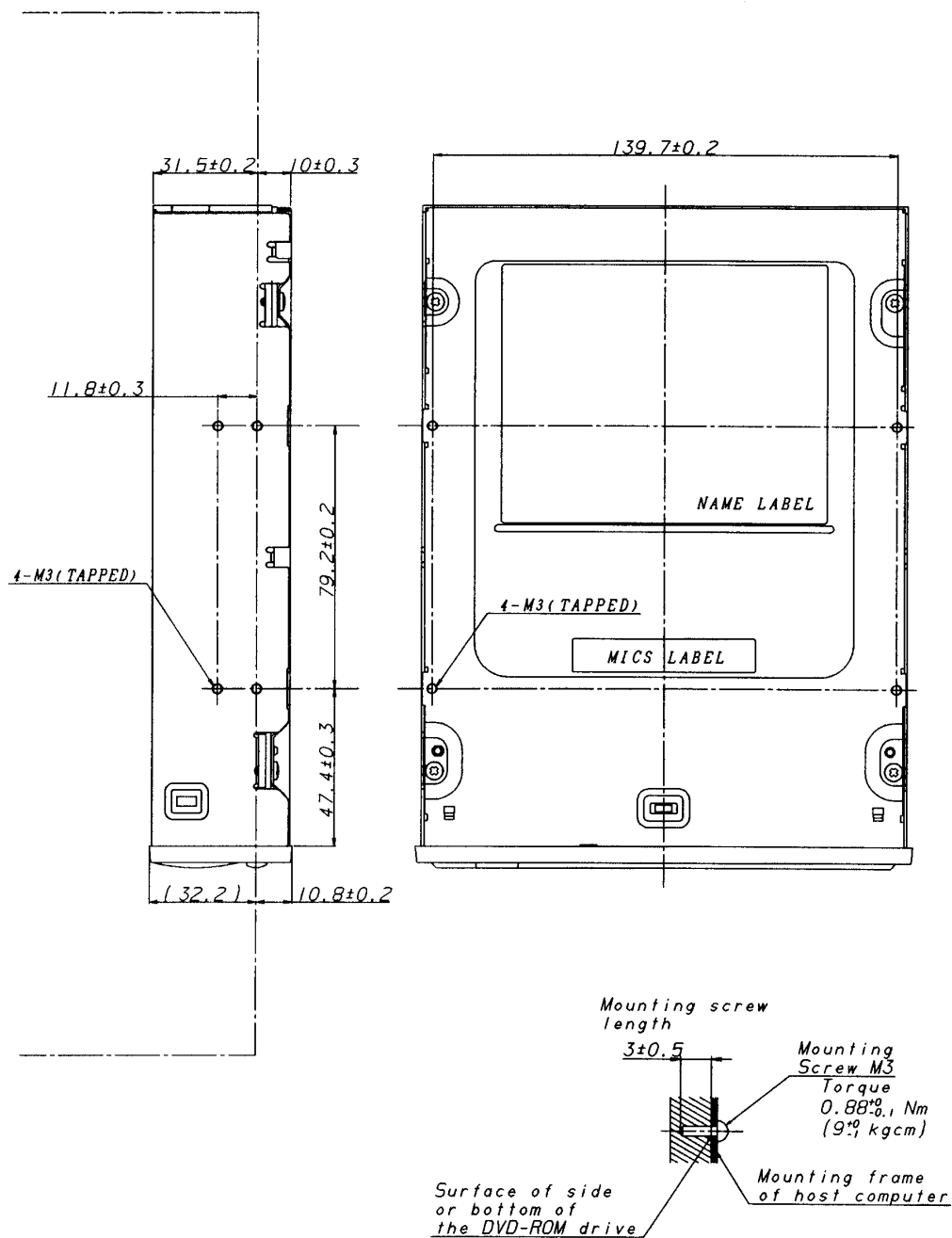
(1) External Dimensions (W x H x D) 146 mm x 41.5 mm x 189.5 mm (excluding bezel)

(2) Mass (Weight) 1.0 kg (Net)
11.0 kg (Bulk Packaged 10pcs.)
16.0 kg (Bulk Packaged 15pcs.) *Probability



(Unit:mm)

Figure 2-1 External Dimensions



(Unit:mm)

Figure 2-2 External Dimensions

3.5. Reliabilites

3.5.1. Error Rate

(1) Hard Read Error Rate (Byte Error Rate) ----- Allowing 5 Retries(default) -----

DVD:	10^{-15} Max
CD:	Mode 1: 10^{-15} Max
	Mode 2: 10^{-12} Max

(2) Seek Error Rate --- Allowing 5 Retries
(default) 10^{-6} Max

3.5.2. MTBF

100,000 h

Assumptions: Power On Hours	5,436 h/year
On/Off Cycles	313 cycles/year
Number of Access	600,000 accesses/year
Operating Duty Cycle (Read)	20 % of Power On Time (Reading/Seeking)
Operating Duty Cycle (Write)	2 % of Power On Time (Writing/Seeking)

3.5.3. MTTR

0.5 h

3.5.4. Drive Life

15,000 h or 5 years (earlier one)

(1) Load/Eject	10,000 times or more
(2) Interface connector Attach/Detach	20 times or more
(3) DC Power connector Attach/Detach	20 times or more

4. Configuration

See Figure 3 for details of the configurations

4.1. Electrical Circuits

- (1) Tray Eject Switch and Eject Detection Switch
- (2) Optical Pickup Servo Drive Circuit
- (3) Feed Motor Drive Circuit
- (4) Laser Diode Control Circuit
- (5) 8-16 Modulated data Demodulator, Error Correction Circuit and CSS Authenticator (DVD)
- (6) EFM Demodulator, Error Correction Circuit and DA converter (CD)
- (7) IDE/ATAPI Control and CD-ROM Error Correction Circuit
- (8) CIRC Encoder
- (9) EFM Encoder
- (10) 8-16 Modulated data Encoder
- (11) ATIP Demodulator
- (12) LPP Demodulator
- (13) Disc Motor Control Circuit

4.2. Optical Pickup

1-Lens and 2-Laser System

4.3. Spindle Motor

Brushless DC Motor

4.4. Feed Motor

DC Motor

4.5. Tray Load/Eject Motor

DC Motor

DVD-R/-RW DRIVE MODEL SD-R5112 BLOCK DIAGRAM

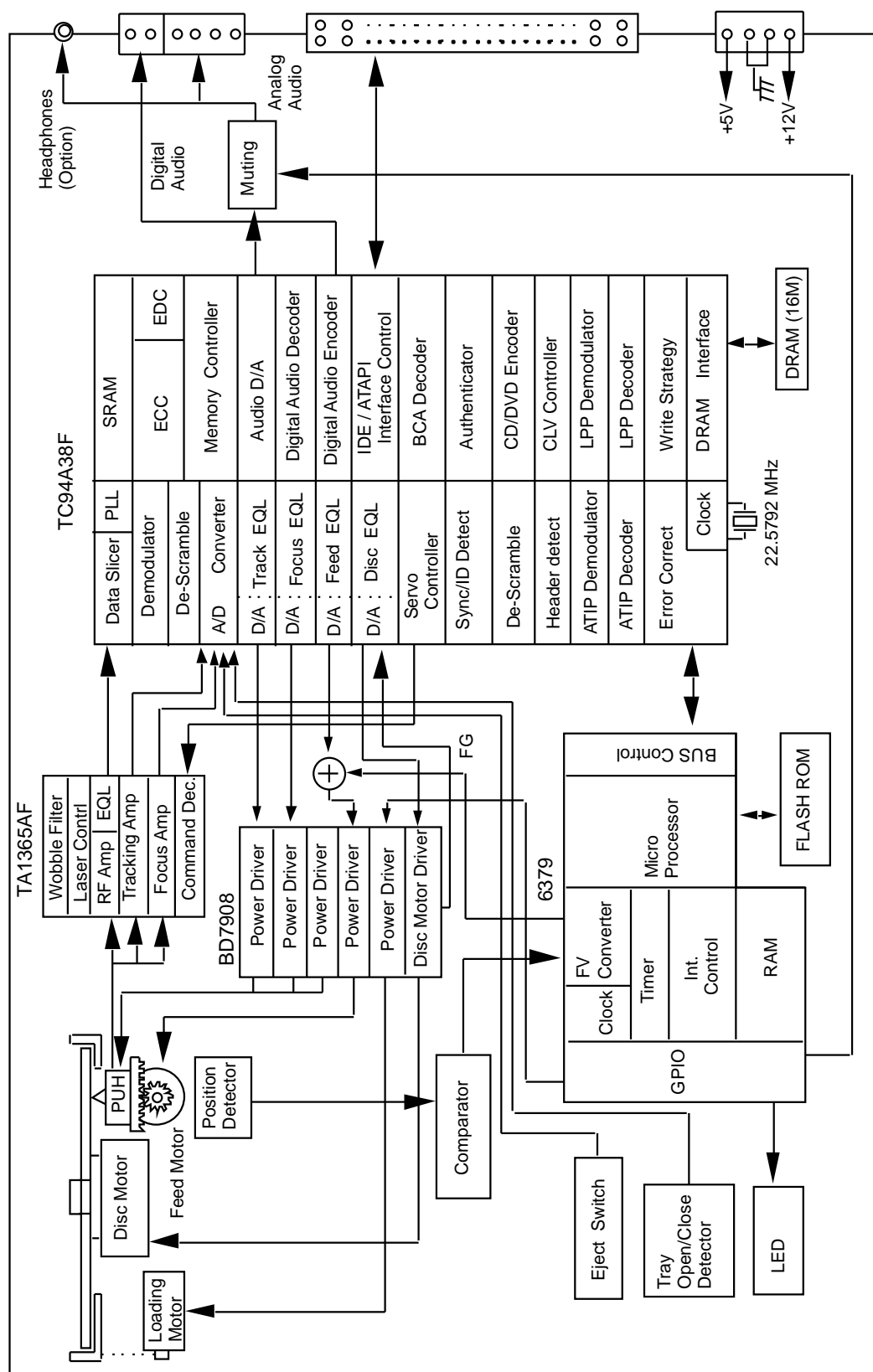


Figure 3 Configuration

5.Functions

5.1. Disc Data Configurations

5.1.1. DVD-ROM Data Configurations

Figure 4 shows how data is constructed in the case of dual layer/parallel track data DVD disc. The DVD spec defines the single layer, the dual layer/opposite and parallel track disc, that the DVD-ROM drive supports. For details refer to DVD Book Part 1.

1 block=1/676 s

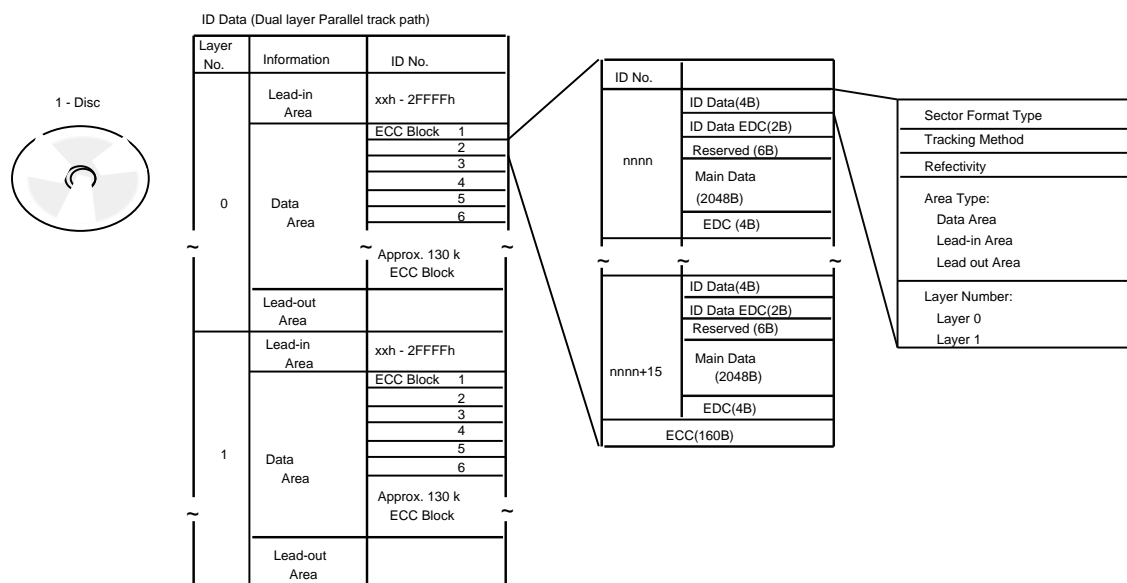


Figure 4 DVD-ROM Disc Data Configuration

5.1.2. CD-ROM Data Configurations

Figure 5 shows how the data is structured in program units

1 block=1/75 s

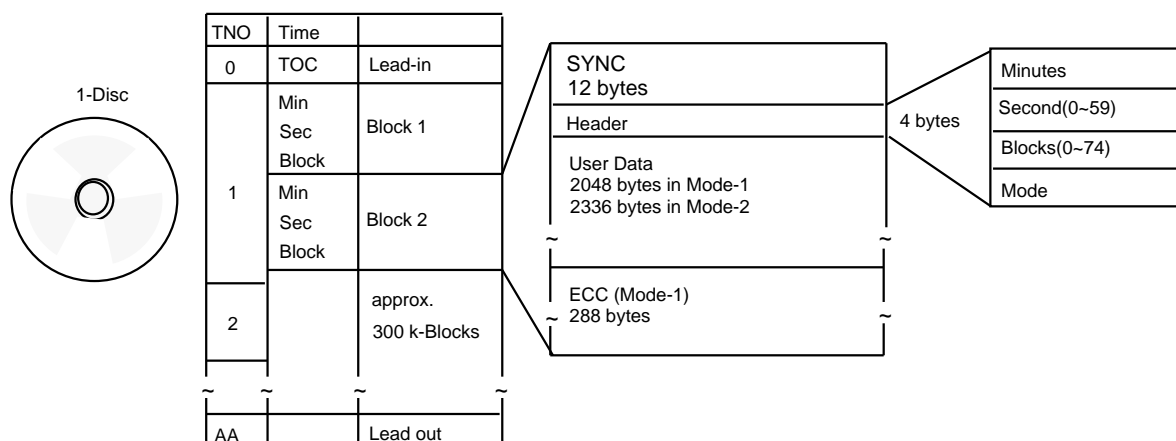


Figure 5 CD-ROM Disc Data Configuration

5.1.3. CD-R / CD-RW Data Configurations

Before writing

CD-R / CD-RW disc contains time-code information called ATIP.

ATIP is abbreviation of "Absolute Time In Pre-groove" in the wobbling groove by modulating the carrier frequency.

(Address information is pre-formatted to ATIP on the CD-R / CD-RW disc and method for the guide groove to wobble by FM modulation.)

Figure 6 shows the composition of ATIP.

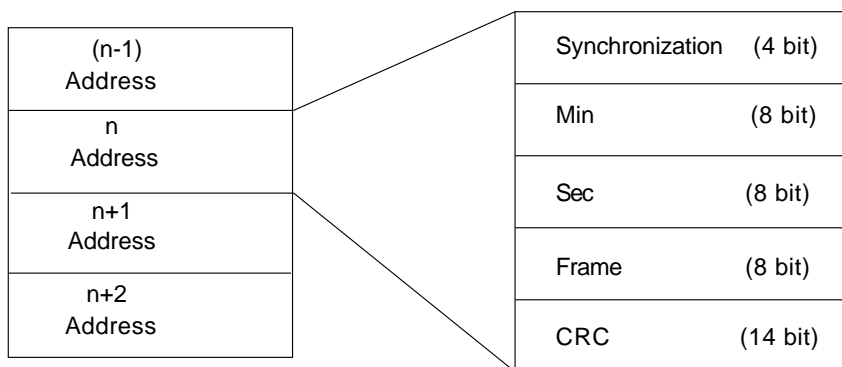


Figure 6 CD-R / CD-RW Disc ATIP Data Configuration

After Writing

Data are written in CD format synchronizing with ATIP.

5.1.4. DVD-R/-RW Data Configurations

Before writing

DVD-R / -RW disc contains ECC block address embossed as the pre-pit information on the land.

The ECC block address is the absolute physical of the track., and corresponds to 16 sector, equal in size to 1 ECC block to be recorded in the groove.

Figure 7 shows the ECC block address structure.

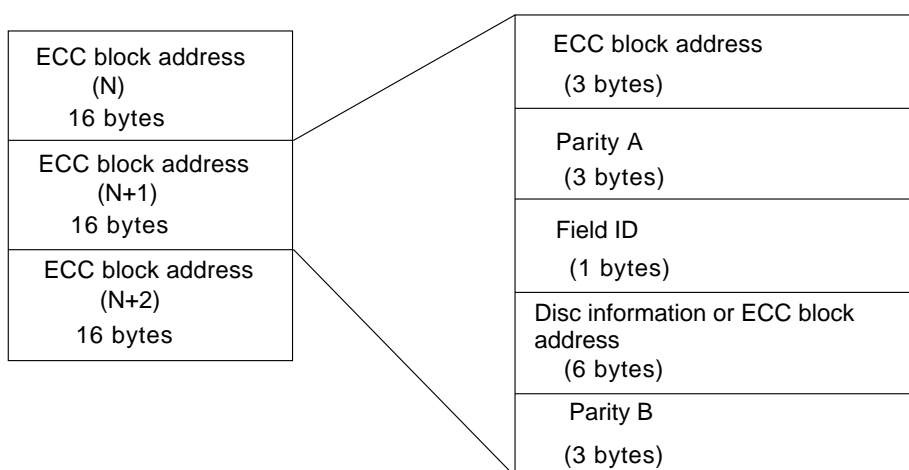


Figure 7 ECC block address structure of DVD-R/-RW disc

After writing

The data is written in DVD-ROM format synchronizing with ECC block address.

5.2. Power ON/OFF Timing (Target)

Figure 8 shows the initialization sequence

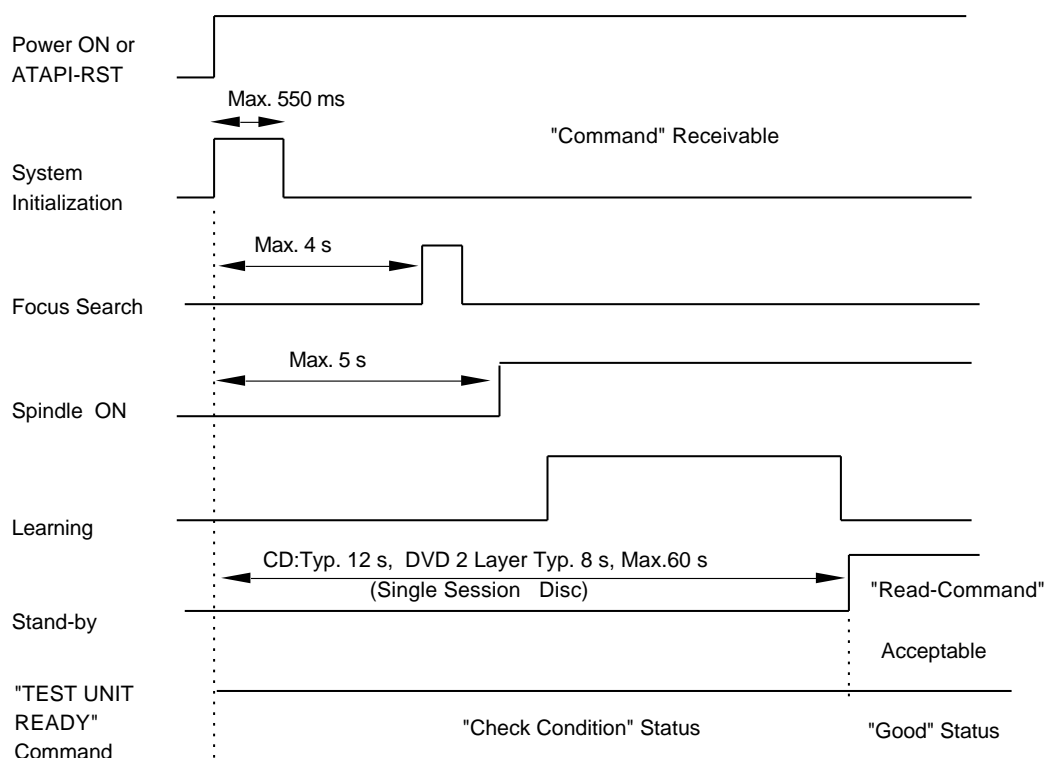


Figure 8 Initialization Sequence

6. Interface

- (1) The interface is based on T13/1321D (AT Attachment with Packet Interface-5, ATA/ATAPI-5) Revision 3 (Feb. 29, 2000), SFF-8020i (Small Form Factor Committee Specification of ATA-Packet Interface for CD-ROMs) Revision 2.6 (Nov. 27, 1995), SFF-8090i Ver. 5, Rev. 1.4 (Oct. 17, 2001).
 - (2) 66 (ATAPI, ATA) commands are usable.
 - (3) The 2 MByte data buffer handles both high speed and low speed data transmission.
 - (4) The largest block size on playback is 2,647 Bytes.
- The data length for each block is changeable by command.

6.1. I/O cable

Table 1 shows the cable parameters.

	Min	Max
Cable length		0.46 m
Driver IoL sink current for 5 V operation	12 mA	
Driver IoL sink current for 3.5 V operation	8 mA	
Driver IoH sink current		-400 μ A
Driver capacitive loading		25 pF

Table 1 Cable parameters

6.2.Signal summary

The physical interface consists of single ended TTL compatible receivers and drivers communicating through a 50P-connector as shown in Figure 13 and Figure 14 "Interface connector".

6.2.1. Signal Specification

Figure 9 shows the Signal Specifications

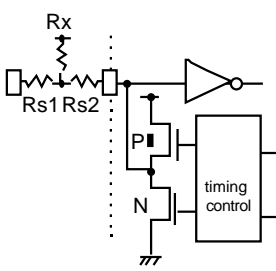
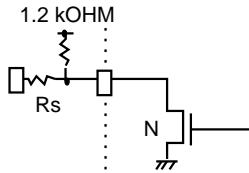
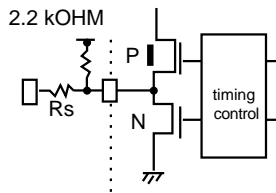
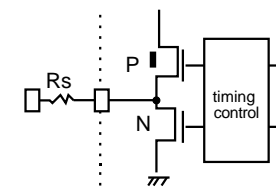
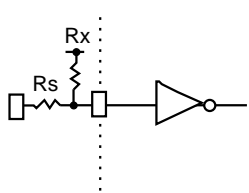
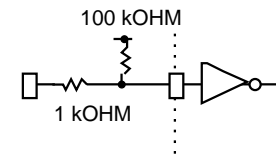
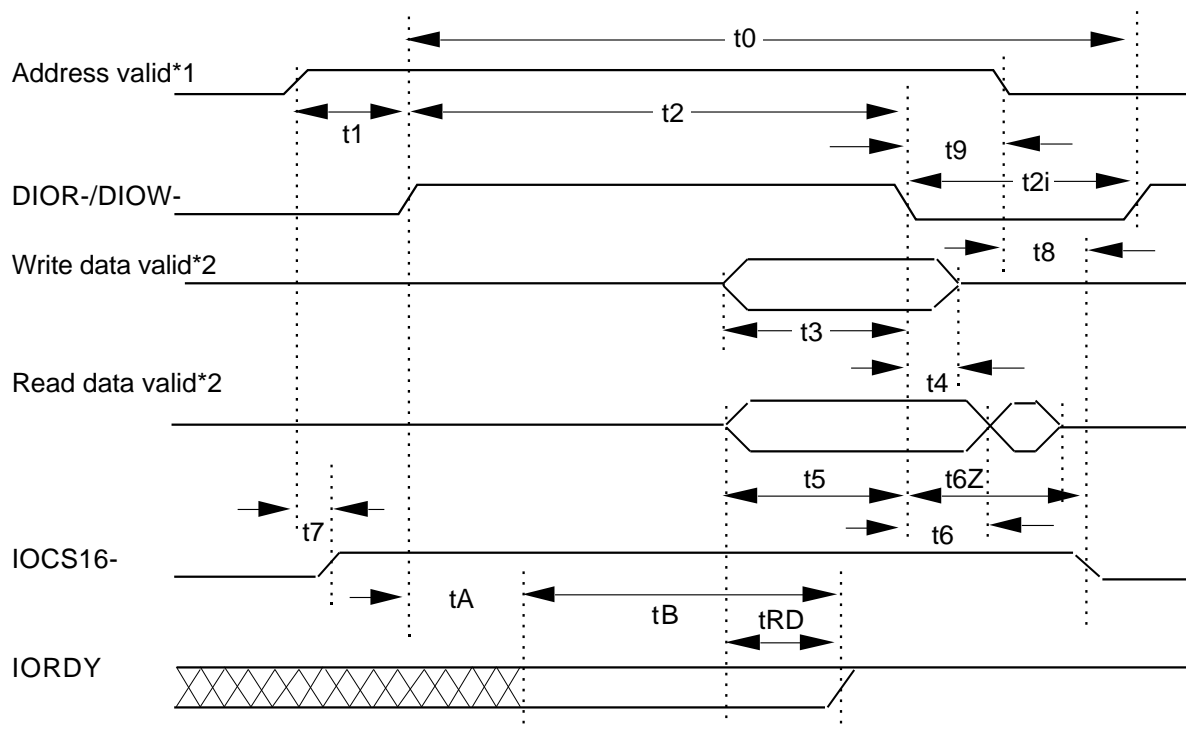
Sig. Name	Type	Receivers/Drivers Characteristics without External pullup Resistor				NOTE	
				Min	Max		Condition
HD0 - HD15 /DASP /PDIAG		VOH	Voltage Output High	Vdd-0.4 V		IOH=1 mA	Bidirectional Rx=10 kOHM Rs1=0 OHM Rs2=33 OHM HD0-HD15 Rx=10 kOHM Rs1=0 OHM Rs2=0 OHM /PDIAG, /DASP
		VOL	Voltage Output Low		0.4 V	IOL=12 mA	
		VIH	Input HIGH Voltage	2.0 V		TTL	
		VIL	Input LOW Voltage		0.8 V	TTL	
		ILI	Input leakage Current	-30 µA	-150 µA	Pullup Resistor(Ri)	
		IOL	Driver sink current	12 mA			
		ILO	Output Leakage Current	-30 µA	-150 µA	Pullup Resistor(Ri)	
		CI	Input Capacitance		8 pF		
		CO	Output Capacitance		8 pF		
/IOCS16		VOL	Voltage Output Low		0.4 V	IOL=24 mA	Open Drain Rs=0 OHM
		IOL	Driver sink current	24 mA			
		ILO	Output Leakage Current	-30 µA	-150 µA	Pullup Resistor(Ri)	
		CO	Output Capacitance		8 pF		
IORDY		VOH	Voltage Output High	2.4 V		IOH=400 µA	Rs=22 OHM
		VOL	Voltage Output Low		0.4 V	IOL=24 mA	
		IOL	Driver sink current	24 mA			
		ILO	Output Leakage Current	-10 µA	10 µA		
		CO	Output Capacitance		8 pF		
/HDRQ /INTRQ		VOH	Voltage Output High	Vdd-0.4 V		IOH=400 µA	Rs=22 OHM /INTRQ /HDRQ
		VOL	Voltage Output Low		0.4 V	IOL=12 mA	
		IOL	Driver sink current	12 mA			
		ILO	Output Leakage Current	-10 µA	10 µA		
		CO	Output Capacitance		8 pF		
/HWR /HRD HA0 - HA2 /HCS1/HCS3 /HDAK		VIH	Input HIGH Voltage	2.0 V		TTL	Rx=infinity Rs=82 OHM /HWR, /HA0-2, Rx=47 kOHM Rs=82 OHM /HDAK Rx=infinity Rs=120 OHM /HRD Rx=10 kOHM Rs=82 OHM /HCS1,/HCS3
		VIL	Input LOW Voltage		0.8 V	TTL	
		ILI	Input leakage Current	-30 µA	-150 µA	Pullup Resistor(Ri)	
		CI	Input Capacitance		8 pF		
RESET		VIH	Input HIGH Voltage	2.4 V			
		VIL	Input LOW Voltage		0.6 V		
		ILI	Input leakage Current	-30 µA	-150 µA	Pullup Resistor(Ri)	
		CI	Input Capacitance		8 pF		

Figure 9 Signal Specifications

6.2.2. Timing of Host Interface (PIO)

Figure 10 shows the Host Interface Timings.



*1:Device Address consists of signals CS0-, CS1-, and DA2-0

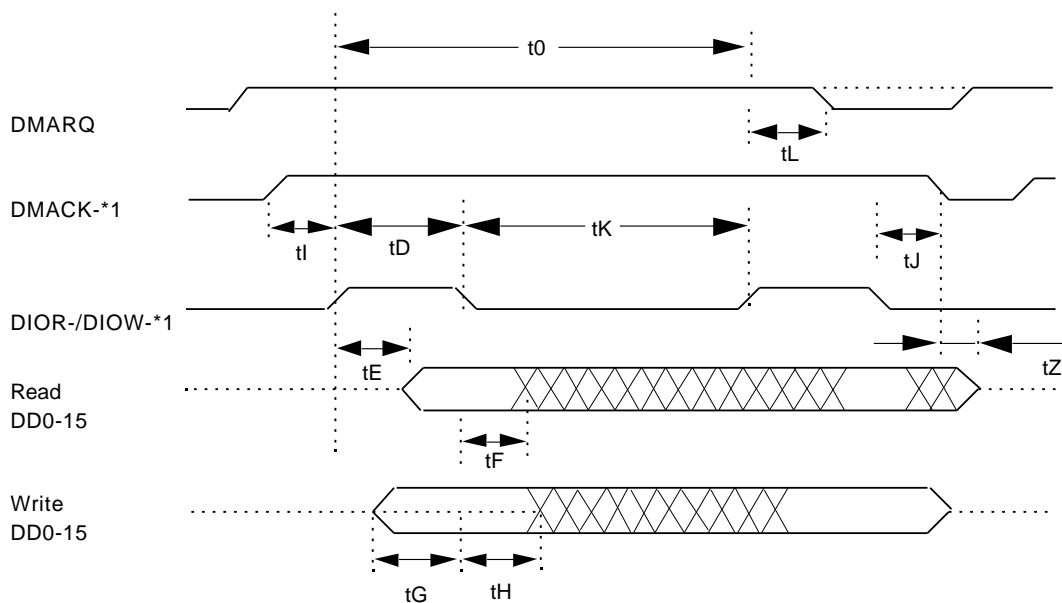
*2:Data consists of DD0-15 (16-bit) or DD0-7 (8-bit)

	PIO timing parameters	min (ns)	max (ns)	Min Time (ns)	Max Time (ns)
t_0	Cycle time			120	
t_1	Address valid to DIOR-/DIOW-setup			25	
t_2	DIOR-/DIOW-pulse wide			70	
t_{2i}	DIOR-/DIOW-recovery time			25	
t_3	DIOW-data setup			20	
t_4	DIOW-data hold			10	
t_5	DIOR-data setup			20	
t_6	DIOR-data hold			5	
t_{6Z}	DIOR-data tristate				30
t_7	Addr valid to IOCS 16-assertion				30
t_8	Addr valid to IOCS 16-negation				30
t_9	DIOR-/DIOW-to address valid hold			10	
t_{RD}	Read Data Valid to IORDY active			0	
t_A	IORDY setup time				35
t_B	IORDY pulse wide				1250

Figure 10 Host Interface Timing

6.2.3. Timing of Host Interface (DMA Multi)

Figure 11 shows the Host Interface DMA multi word Timings



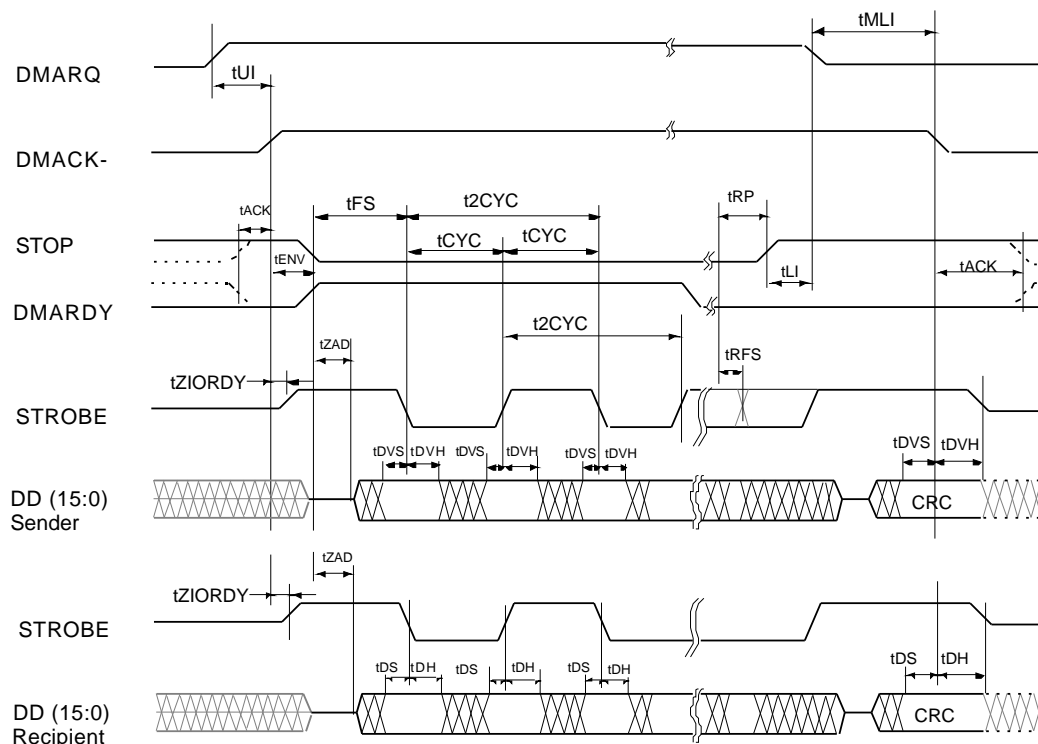
*1: In all timing diagrams, the low line indicator negated, and the upper line indicators asserted.

	Multi word DMA timing parameters	min(ns) max(ns)	Min time (ns)	Max time (ns)
t0	Cycle time		120	
tC	DMACK to DMREQ delay			---
tD	DIOR-/DIOW- 16-bit		70	
tE	DIOR- data access			---
tF	DIOR- data hold		5	
tZ	DMACK- to tristate			25
tG	DIOR/DIOW- data setup		20	
tH	DIOW- data hold		10	
tI	DMACK to DIOR-/DIOW- setup		0	
tJ	DIOR-/DIOW- to DMACK hold		5	
tKr	DIOR- negated pulse width		25	
tKw	DIOW- negated pulse width		25	
tLr	DIOR- to DMREQ delay			35
tLw	DIOR- to DMREQ delay			35

Figure 11 Host Interface Timing (DMA Multi)

6.2.4. Timing of Host Interface (Ultra DMA)

Figure 12 shows the Host Interface Ultra DMA word Timings



In all timing diagrams, the low line indicator negated, and the upper line indicators asserted.

	Ultra DMA Mode 2 Timing parameters min (ns) max (ns)	Min time (ns)	Max time (ns)
t2CYC	Typical Sustained Average Cycle time	120	
	Two cycle time (from rising edge to next rising edge of from falling edge to next falling edge of STROBE)	117	
tCYC	Cycle time allowing	55	
tDVS	Data valid Setup time	34	
tDVH	Data valid Hold time	6	
tUI	Unlimited Interlock time	0	
tACK	Setup and Hold Time for DMACK-	20	
tENV	Envelope time	20	70
tZAD	Minimum Delay time for Driver	0	
tZIORDY	Minimum time for DMACK-	20	
tFS	First STROBE time	0	170
tRFS	Ready-to-Final STROBE time		50
tRP	Ready-to-Pause time	100	
tLI	Limited Interlock time	0	150
tMLI	Interlock with minimum	20	
tDS	Data setup time (at recipient)	7	
tDH	Data hold time (at recipient)	5	

Figure 12 Host Interface Timing (Ultra DMA)

6.3. Connector

Figure 13 shows the mixture connector (Interface/Power supply)

Table 2 shows Interface connector pin assignment.

power supply connector

PIN #1 : 12 V

PIN #2 : GND

PIN #3 : GND

PIN #4 : +5 V

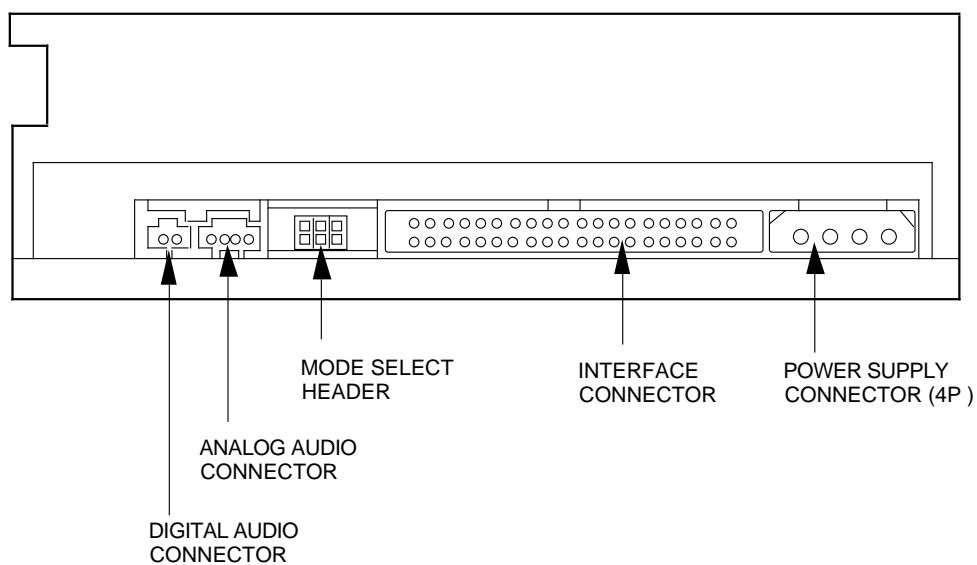
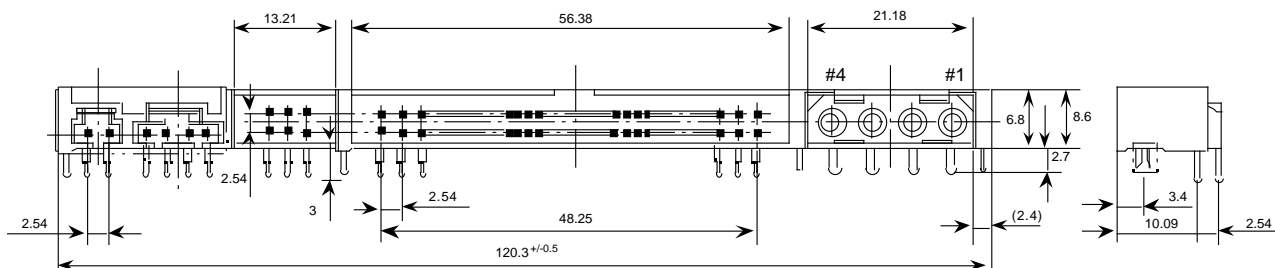


Figure 13

PIN NO.	I / O	SIGNAL NAME	HOST SIGNAL NAME
1	I	Reset -	Host Reset
2	-	GND	
3	I / O	HD7	Host Data Bus BIT 7
4	I / O	HD8	Host Data Bus BIT 8
5	I / O	HD6	Host Data Bus BIT 6
6	I / O	HD9	Host Data Bus BIT 9
7	I / O	HD5	Host Data Bus BIT 5
8	I / O	HD10	Host Data Bus BIT 10
9	I / O	HD4	Host Data Bus BIT 4
10	I / O	HD11	Host Data Bus BIT 11
11	I / O	HD3	Host Data Bus BIT 3
12	I / O	HD12	Host Data Bus BIT 12
13	I / O	HD2	Host Data Bus BIT 2
14	I / O	HD13	Host Data Bus BIT 13
15	I / O	HD1	Host Data Bus BIT 1
16	I / O	HD14	Host Data Bus BIT 14
17	I / O	HD0	Host Data Bus BIT 0
18	I / O	HD15	Host Data Bus BIT 15
19	-	GND	
20	-	(KEYPIN)	
21	O	HDRQ	DMA Request
22	-	GND	
23	I	HWR-,STOP	Host I / O Write
24	-	GND	
25	I	HRD-, HDMARDY-HSTROBE	Host I / O Read
26	-	GND	
27	O	IORDY, DDMARDY-DSTROBE	I / O Channel Ready
28	-	CSEL	Cable Select
29	I	HDAK-	DMA Acknowledge
30	-	GND	
31	O	INTRQ	Host Interrupt Request
32	O	IOCS16-	Host 16 BIT I / O
33	I	HA1	Host Address Bus BIT 1
34	I / O	PDIAG-	Passed Diagnostics
35	I	HA0	Host Address Bus BIT 0
36	I	HA2	Host Address Bus BIT 2
37	I	HCS1-	Host CHIP Select 0
38	I	HCS3-	Host CHIP Select 1
39	I / O	DASP-	Drive Active/Drive 1 Present
40	-	GND	

Table 2 Interface Connector PIN Assignment

6.4. Support Command List

ATAPI Packet Commands

No	OP Code	Command Description
1	00h	Test Unit Ready
2	01h	Rezero Unit
3	03h	Request Sense
4	04h	Format Unit
5	12h	Inquiry
6	1Bh	Start / Stop Unit
7	1Ch	Receive Diagnostics
8	1Dh	Send Diagnostic
9	1Eh	Prevent / Allow Medium Removal
10	23h	Read Format Capacities
11	25h	Read Capacity
12	28h	Read (10)
13	2Ah	Write (10)
14	2Bh	Seek (10)
15	35h	Synchronize Cache
16	42h	Read Sub-Channel
17	43h	Read TOC / PMA / ATIP
18	44h	Read Header
19	45h	Play Audio (10)
20	46h	Get Configuration
21	47h	Play Audio MSF
22	4Ah	Get Event Status Notification
23	4Bh	Pause / Resume
24	4Eh	Stop Play / Scan
25	51h	Read Disc Information
26	52h	Read Track / RZone Information
27	53h	Reserve Track / RZone
28	54h	Send OPC Information
29	55h	Mode Select (10)
30	58h	Repair RZone
31	5Ah	Mode Sense (10)
32	5Bh	Close Track / RZone / Session / Border
33	5Ch	Read Buffer Capacity
34	5Dh	Send Cue Sheet
35	A1h	Blank
36	A2h	Send Event
37	A3h	Send Key
38	A4h	Report Key
39	A5h	Play Audio (12)
40	A7h	Set Read Ahead
41	A8h	Read (12)
42	AAh	Write (12)
43	ACh	Get Performance
44	ADh	Read DVD Structure
45	B6h	Set Streaming
46	B9h	Read CD MSF
47	BAh	SCAN
48	BBh	Set CD Speed
49	BDh	Mechanism Status
50	BEh	Read CD
51	BFh	Send DVD Structure

ATA Commands

No	OP Code	Command Description
1	00h	NOP
2	08h	DEVICE RESET
3	20/21h	READ SECTOR (S)
4	90h	EXECUTE DEVICE DIAGNOSTICS
5	A0h	PACKET
6	A1h	IDENTIFY PACKET DEVICE
7	E0h	STANDBY IMMEDIATE
8	E1h	IDLE IMMEDIATE
9	E2h	STANDBY
10	E3h	IDLE
11	E5h	CHECK POWER MODE
12	E6h	SLEEP
13	E7h	FLUSH CACHE
14	ECh	IDENTIFY DEVICE
15	EFh	SET FEATURE

7. Power Requirements

7.1. Source Voltage +5 V +/- 5 % (Operating) +12 V +/- 5 % (Operating)
+/- 8 % (Start up) +/- 8 % (Start up)

7.1.1.Spike 100 mV (p-p) Max.

7.1.2.Ripple 100 mV (p-p) Max.

7.2. Current Drain (These value of 1st experiment drive)

	<u>+5 V</u>	<u>+12 V</u>
7.2.1.Sleep	50 mA (DVD/CD)	60 mA (DVD/CD)
7.2.2.Standby (Laser off, Motor off)	80 mA (DVD/CD)	60 mA (DVD/CD)
7.2.3.Continuous Read (Data)	520 mA (DVD) 540 mA (CD)	600 mA (DVD) 700 mA (CD)
7.2.4.Idle (Laser on, Motor on)	450 mA (DVD)	300 mA (DVD)
7.2.5.Average (20% Random Access)	480 mA (DVD) 520 mA (CD)	600 mA (DVD) 720 mA (CD)
7.2.6.Maximum (100% Random Access)	500 mA (DVD) 550 mA (CD)	750 mA (DVD) 850 mA (CD)
7.2.7.Peak in executing Access (Exclude Spike Current)	1,200 mA (DVD) 1,200 mA (CD)	1,600 mA (DVD) 1,600 mA (CD)
*Spike: Less than 1 ms of duration		
7.2.8.Write (CD-R 12/16X ZCLV)	650 mA	450 mA
Write (DVD-R 4X CLV)	600 mA	350 mA

8.CD Audio (Test condition: Ordinary temperature)

8.1. Analog Out --- in case of the attenuator is set at 0 dB by the command ---

- | | |
|---------------------------|----------------------------------|
| (1) Output Level | 0.79 V (rms) Typ. |
| (2) Type | Unbalanced |
| (3) Load Impedance | 47 kOHM min. |
| (4) Frequency Response | 20 Hz to 20 kHz +/-3 dB |
| (5) Distortion | -73 dB (at 1 kHz JIS A-Weighted) |
| (6) Signal to Noise Ratio | 80 dB Typ. (IEC 179 A-weighted) |

8.2. Digital Out

- | | |
|--------------------|--------------|
| (1) Output Level | 0.50 V (p-p) |
| (2) Type | Unbalanced |
| (3) Load Impedance | 75 OHM |

8.3. Connector

4P connector and 2P connector.

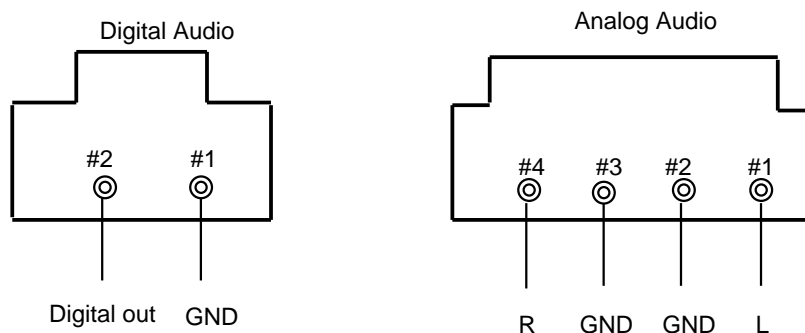


Figure 14

8.4. Audio Modes

- (1) 16 Modes including 'Stereo', 'Lch Mono', 'Rch Mono' and 'Mute' are selectable by command.
Default mode is 'Stereo'. Audio out is automatically muted in the digital data area and seek state.
- (2) 16 Steps of attenuation level for the Audio Output is selectable by command.
Default level is 0 dB.

8.5. Headphones Output (Option).....in case of the attenuator set at 0 dB by the command.....

- | | |
|-----------------------------|------------------------------------|
| (1) Output Level | 0.90 V (rms) Typ. |
| (2) Level Adjust Controller | Continuous Type (Thumb Wheel Knob) |
| (3) Load Impedances | 100 OHM (Nominal) |

8.5.1. Connector

3.5 mm dia. Stereo Headphones Jack.

10. Busy Indicator

The LED of Front Bezel indicates the drive status. (Busy Indicator)

Color: Green

(1) After Tray is closed, Busy Indicator start blinking at 0.8 s intervals, and then -----

(1-1) Turns off when the drive in the 'Idle' status.

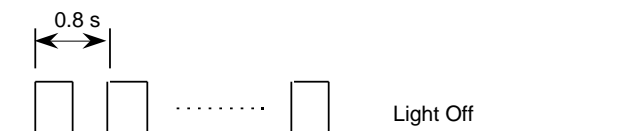


Figure 16 Idle

(1-2) Continuously off when no disc is mounted.

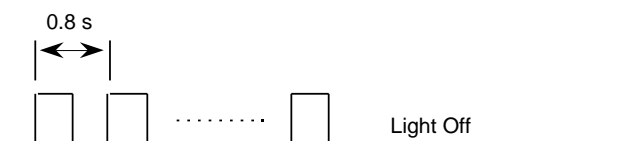


Figure 17 No disc

(1-3) Continuously on when media has problem



Figure 18 Media Problem

(2) When playing an audio track, Busy Indicator is blinking at 1.6 s intervals.

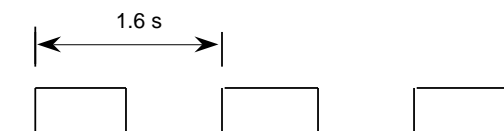


Figure 19 CD-Audio playback

(3) When performing 'Data Access' and during 'Data Transfer' and 'Write', Busy Indicator keeps turn on.

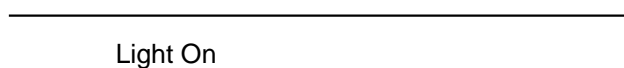


Figure 20 Data Access and Data Transfer

11.Connection

11.1. Power Supply Cable

(1) Housing	AMP JAPAN P/N 1-480424-0 or equivalent
(2) Contact	AMP JAPAN P/N 170148-2 or equivalent
(3) Cable Length	AWG #28 Max. 2 m

11.2. Interface Cable

(1) Connector	ATAPI specification
(2) Cable	40 core type
Specific Impedance	100 OHM +/-10 % (without shield)
Length	Max. of 0.46 m for total ATAPI bus length

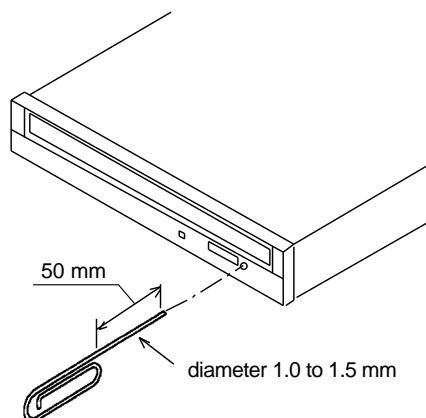
11.3. Audio Cable

	Unbalanced and shielded
(1) Capacitance	Less than 1000 pF
(2) Length	Max. 3 m

12.Emergency Eject

Execute following procedure only in the case of emergency (Tray will not eject and disc can not be removed although pressing Eject Button).

- (1) Turn the drive supplying power off.
- (2) Insert solid bar (like paper clip) into Emergency Eject hole and push as shown in Fig.21.
Then Tray will be ejected.
- (3) After removed the disc, gently push Tray to close.



Figurer 21 Insert the bar

13. Safety Standards/Agency Approvals

(1) Safety	EN60950 UL 1950 CAN/CSA-22.2 No.950
(2) Laser	FDA 21CFR (U.S.A./DHHS) EN60825-1 (Europe)
(3) EMC	CE EN50081-1 : 1992 [Residential, commercial & light industry] EN55022 : 1998 [Class B] EN55024+A1 : 1998+2001 [Information Technology equipment- Immunity characteristics Limits and methods of masurement] IEC61000-4-2+A1 : 1995+1998 [CD:4 kV, ID: 4 kV, AD:8 kV] IEC61000-4-3+A1 : 1995+1998 [3 V/m, 80-1000 MHz, 1 kHz 80 % AM] IEC61000-4-4 : 1995 [AC-line: 1 kV, I/F 0.5 kV f: 5 kHz, Polarity: +/-] IEC61000-4-5 : 1995 [AC-line: 2 kV/1 kV, Polarity: +/-] IEC61000-4-6 : 1996 [3 V, 0.15-80 MHz, 80 % AM] IEC61000-4-8 : 1993 [1 A/m, 50 Hz] IEC61000-4-11 : 1994 [>95 % 0.5, 30% 25, >95 250] TAIWAN EMI CNS 13438

14. Electrostatic Discharge

Standard	IEC61000-4-2
(1) Operating (Read)	8 kV or less
(2) Operating (Write)	8 kV or less
(3) Damage including	15 kV or more

15. Accessories

1-Short Jumper
(installed in 'MA' header)
1-Safety Instruction Manual

16. Packaging

(1) 15 unit in a bulk package	24 bulk packs on one pallet. *All transportation is allowed with pallet. (Transportation with bulk package is not allowed.)
(1) 10 unit in a bulk package	28 bulk packs on one pallet. *All transportation is allowed with pallet. (Transportation with bulk package is allowed.)

17. CE Declaration of conformity

Please refer to attached Annex 1.

TOSHIBA

TOSHIBA EUROPE GMBH

EU-Declaration of Conformity

Product: DVD-R/-RW Drive

Manufacturer(s): Toshiba Corporation
1-1, Shibaura 1-chome, Minato-ku, Tokyo 105-8001 Japan

See page 2 for other locations

Model: SD-R5112

Options: None

Toshiba declares that the above mentioned product(s) with or without the listed options comply to the EU-Directives and standards as listed on page 2.

Last two digits of the year in which the CE mark affixed : 03

Responsible for CE-marking: Toshiba Europe GmbH

Signed by: Mr. K.Hachisu, President of Toshiba Europe GmbH

Place: D-41460 Neuss

Date: January 13, 2003

Signature: _____

This declaration certifies compliance with the listed directives, but does not constitute an assurance of characteristics.

The safety information in the supplied product documentation must be observed.

Document No.:	YEA-R3457	Page: 1 of 2
[History if issue]	Issued : Jan. 09, 2003	
	Revision A :	Ref.:
	Revision B :	Ref.:
	Revision C :	Ref.:
	Revision D :	Ref.:

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GESCHAFTSUHRER
HISATSUGU NONAKA
HRB 3479 AMTSGERICHT NESS

Annex 1

EU-Declaration of Conformity

ED-Directive	Related Standard	Issue	Level/Test condition
89/336/EEC (EMC Directive)	EMC-emission:	1992	Residential, commercial & light industry
	EN55022	1998	Class B
	EMC-immunity	1998+2001	Information Technology equipment-Immunity characteristics Limits and methods of measurement
	EN55024+A1		CD: 4 kV, ID: 4 kV, AD: 8 kV
	IEC61000-4-2+A1	1995 +1998	3 V/m, 80-1000 MHz, 1 kHz 80 % AM
	IEC61000-4-3+A1	1995 +1998	AC-line: 1 kV, I/F 0.5 kV f: 5 kHz, Polarity: +/-
	IEC61000-4-4	1995	AC-line: 2 kV/1 kV, Polarity: +/-
	IEC61000-4-5	1995	3 V, 0.15-80 MHz, 80 % AM
	IEC61000-4-6	1996	1 A/m, 50 Hz
	IEC61000-4-8	1993	
	IEC61000-4-11	1994	>95 % 0.5, 30% 25, >95 250

Product/Options	Model	Related EU-Directive 89/336/EEC
DVD-R/-RW Drive	SD-R5112	X
Manufacturer(s) Location	Address	
Toshiba Multi Media Devices Co, Ltd	19 Minase, Fukiata Goshogawara-shi, Aomori 037-0003 Japan	
Toshiba Misawa Media Devices Co, Ltd	3-31-2779, Minami-cho, Misawa-shi, Aomori-ken 033-0036 Japan	
Tsugaru Technica Co., Ltd.	81-87 Iwai, Aiuchi, Shiura-machi, Kitatsugaru-gun, Aomori, 037-0401 Japan	
EMS Corp.	4-5 Aza-Shoubu, Ohaza-Ubayachi Goshogawara-shi, Aomori 037-0015 Japan	
EMS Kizukuri Corp.	1-2 Aza-Miyazaki, Kizukuri-machi, Nishi-Tugaru-gun Aomori 038-3157 Japan	
EMS Fukaura Co., Ltd	24-1 Aza Azumazawa, Ohaza Fukaura, Fukaura-machi, Nishi-Tsugaru-gun, Aomori, 038-2324 Japan	
Emusu Itayanagi Co., Ltd.	13-10, Matsumoto, Tsuji, Itayanagi, Kita-Tyugaru-gun, Aomori, 038-3645 Japan	
Toshiba Information Equipment (Philippines) Inc	103 East Main Avenue Extension, Special Export Processing Zone, Laguna Technopark, Binan, Laguna Philippines	
Integrated Microelectronic Inc.	North Science Avenue Laguna Technopark, Binan Laguna, Philippines	
Hokuto Communication Industrial Co., Ltd.	207 Aza Koamon, Rokugo, Rokugo-machi, Senboku-gun, Akita 019-1404 Japan	
Alco Electronics Ltd.	The 3rd Industrial District Dongguan, Han Kai, Guangdong 523961 China	

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Revision:

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Deviation List

Page	Item	Rev # 0.9	Rev # 1.0
2	3.1.Performance (2) Applicable Write Disc DVD-R	DVD-R (Ver2.0 for General)	DVD-R for General (Ver2.01) Optional Spec. Rev.1.0
	DVD-RW	DVD-RW (Ver1.1)	DVD-RW (Ver1.1) Optional Spec. Rev.1.0
	(3) Applicable Read Disc DVD	DVD-R (Ver.1.0, Ver.2.0)	DVD-R for General (Ver.2.01)
5	3.2. Environmental Conditions (8) Storage Humidity	5 % to 95 % (Wet bulb Maximum Temperature 27 °C)	5 % to 95 % (Wet bulb Maximum Temperature 40 °C)
	(9) Shipping Humidity	5 % to 95 % (Wet bulb Maximum Temperature 27 °C)	5 % to 95 % (Wet bulb Maximum Temperature 40 °C)
22	7.2. Current Drain (+5 V) 7.2.1.Sleep	TBD mA (DVD/CD)	50 mA (DVD/CD)
	7.2.2.Standby	TBD mA (DVD/CD)	80 mA (DVD/CD)
	7.2.3.Continuous Read	TBD mA (DVD) TBD mA (CD)	520 mA (DVD) 540 mA (CD)
	7.2.4.Idle	TBD mA (DVD)	450 mA (DVD)
	7.2.5.Average	TBD mA (DVD) TBD mA (CD)	480 mA (DVD) 520 mA (CD)
	7.2.6.Maximum	TBD mA (DVD) TBD mA (CD)	500 mA (DVD) 550 mA (CD)
	7.2.7.Peak in executing Access	TBD mA (DVD) TBD mA (CD)	1,200 mA (DVD)) 1,200 mA (CD)

Page	Item	Rev # 0.9	Rev # 1.0
22	7.2.8. Write (CD-R 12/16X ZCLV)	TBD mA	650 mA
	Write (DVD-R 4X CLV)	TBD mA	600 mA
	7.2. Current Drain (+12V)		
	7.2.1. Sleep	TBD mA (DVD/CD)	60 mA (DVD/CD)
	7.2.2. Standby	TBD mA (DVD/CD)	60 mA (DVD/CD)
	7.2.3. Continuous Read	TBD mA (DVD) TBD mA (CD)	600 mA (DVD) 700 mA (CD)
	7.2.4. Idle	TBD mA (DVD)	300 mA (DVD)
	7.2.5. Average	TBD mA (DVD) TBD mA (CD)	600 mA (DVD) 720 mA (CD)
	7.2.6. Maximum	TBD mA (DVD) TBD mA (CD)	750 mA (DVD) 850 mA (CD)
	7.2.7. Peak in executing Access	TBD mA (DVD) TBD mA (CD)	1,600 mA (DVD) 1,600 mA (CD)
	7.2.8. Write (CD-R 12/16X ZCLV)	TBD mA	450 mA
	Write (DVD-R 4X CLV)	TBD mA	350 mA